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RADIATION PROTECTION AT THE PADUCAH GASEOUS DIFFUSION PLANT

RADIATION PROTECTION PROGRAM

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PREFACE

The Paducah Gaseous Diffusion Plant (PGDP) historically operated as a chemical plant. The Radiological Protection Program was designed to control personnel exposure to uranium salts with recognition of uranium as a heavy metal kidney toxin. In the 1950 and 1970 time frame, uranium recycled from spent reactor fuel from government reactors was processed through PGDP and reenriched in the uranium-235 (U-235) isotope. This recycled material contained neptunium and plutonium, known as transuranic elements, which were deposited at varying concentrations on equipment surfaces and in reactor ash. During the cascade improvement and cascade uprating programs in the late 1970s and 1980s, a large percentage of the transuranics were removed as most of the process barrier and some equipment were replaced with more efficient barrier and equipment. However, some residual transuranic contamination remained.

Department of Energy (DOE) 5480.11 required massive changes in the Radiological Protection Program at PGDP. Most notable of these changes were radiological posting, personnel and equipment monitoring, control of radiation at the source, and improvements in internal and external dosimetry programs. Implementation at PGDP was complicated by the presence of transuranics.

Since 1988, the PGDP Health Physics Program has undergone almost exponential growth in responsibilities and personnel. Recognizing that growth without thorough and complete planning is undesirable, PGDP refined the overall planning to meet the required improvements in the protection program. The component elements of this plan, the PGDP Radiation Protection Program, the Strategic Management Plan for Radiation Protection Program Upgrade, the Tactical Management Plan for Radiation Protection Program Upgrade, and the Implementation Plan for DOE 5480.11 comprise the four volumes of this report series, *Radiation Protection at the Paducah Gaseous Diffusion Plant*, KY/E-114.

Volume I of the series is the Radiation Protection Program. This volume establishes the criteria for radiation protection at PGDP. It outlines program requirements and defines responsibilities and functions.

The Strategic Management Plan for Radiation Protection Program Upgrade (Volume II) describes in broad terms how PGDP will create a radiation protection program equivalent to those found in most nuclear facilities.

Volume III, the Tactical Plan for Radiation Protection Program Upgrade, outlines the detailed steps and schedules for the accomplishment of the Radiation Protection Program upgrade. This document will be subject to periodic revision dependent upon operational priorities, approved funding, and resource allocations.

Preparation of an implementation plan for DOE 5480.11 is an annual requirement. Volume IV will consist of the current year's revision of the plan and will project actions needed to assure 100 percent compliance.

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POLICY

Martin Marietta Energy Systems, Inc., (Energy Systems) and the Paducah Gaseous Diffusion Plant (PGDP) have the responsibility for providing a workplace environment in which employees, visitors, and contractors are adequately protected from hazards, including the hazards associated with exposure to radiation and radioactive material.

While the majority of occupational radiation exposures at PGDP are very low, all exposures must be viewed as preventable. Therefore, the management of PGDP has adopted the following three principles to govern all work activities with the potential for exposure to radiation or radioactive materials.

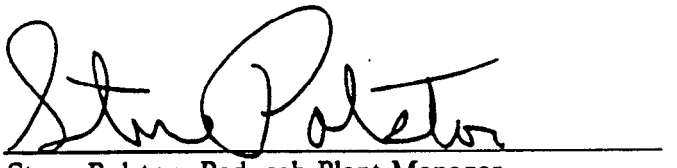
1. There will be no unnecessary exposures to ionizing radiation or radioactive materials.

2. All radiation exposures will be kept as low as reasonably achievable (ALARA).

3. No individual will receive radiation doses in excess of federal or administrative limits.

As with all aspects of safety, radiation protection is a line responsibility extending from the plant manager to the deputy plant manager to division managers, department heads, program managers, all levels of supervision, and to all other employees. Each of us must assume the responsibility for maintaining our radiation exposures ALARA.

All positive indications of contamination of persons, equipment, or facilities shall be promptly communicated to supervision and the Health Physics Department. They are responsible to conduct follow-up investigations, to determine the source of the contamination, to prevent further spread of radioactive material, and to preclude any material from leaving the site.



Steve Polston, Paducah Plant Manager

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EXECUTIVE SUMMARY

It is the policy of the Paducah Gaseous Diffusion Plant (PGDP) to provide a safe and healthy work environment for its employees, visitors, and contractors. All persons entering the plant will be adequately protected from physical, chemical, and biological hazards, including the hazards associated with exposure to ionizing radiation and radioactive materials.

While the majority of occupational radiation exposures are low, it is well recognized that any exposure to ionizing radiation or radioactive materials entails some risk. Therefore, the following four principles shall govern all aspects of work activities that present a potential for exposure to ionizing radiation and radioactive materials:

1. There shall be no unnecessary or unplanned exposures to ionizing radiation or radioactive materials.

2. All radiation exposures and releases of radioactive effluents to the work environment shall be kept as low as reasonably achievable (ALARA), societal and economic costs being taken into account.

3. Radiation exposure limits for personnel and members of the general public, as promulgated by the U. S. Department of Energy (DOE) in DOE 5480.11 and 5400.5, shall not be exceeded.

4. Control measures instituted to maintain radiation exposures ALARA will not increase an individual's risk of harm from other nonradiological hazards.

Implementation of this policy will be accomplished by a division of operational and programmatic responsibility. Line management is charged with the implementation of this program. The manager of the Health Physics Department is responsible to provide operational and technical support to line management and for overall program management. The PGDP Radiation Protection manager shall be responsible for the development of programs to guide line and plant management. The PGDP Contamination Control manager shall be responsible for the development of programs to limit the spread of radioactive contamination. The ALARA program manager shall be responsible for the development and management of programs to reduce radiation exposure at PGDP. The Dosimetry program manager shall be responsible for the development and accomplishment of programs to quantify employees' exposure to ionizing radiation.

Programmatic responsibility will be accomplished as follows:

1. The manager of Health Physics shall carry out this Radiation Protection Program and support the ALARA, dosimetry, and contamination control activities of PGDP.

2. Program managers will report to the deputy plant manager; the manager of the Environmental, Safety, and Health (ES&H) Division or the manager of the Health Physics Department; or some other individual having overall ES&H responsibility as determined by the plant manager.

3. Employees are directed to comply with this plant policy, this plan, and all radiation protection procedures; to report any violations of procedures that they may observe; and to make suggestions concerning improvement of radiation protection procedures.

All positive indications of contamination, greater than allowable limits, of persons, equipment, or facilities shall be promptly communicated to supervision and the Health Physics Department. They are responsible to conduct follow-up investigations, to determine the source of the contamination, to prevent further spread of radioactive material, and to preclude any material from leaving the site in quantities above limits specified by DOE and Martin Marietta Energy Systems, Inc. (Energy Systems) policy.

This programmatic approach must be integrated into all aspects of our operations. As individuals, we must assume responsibility for keeping our own exposures ALARA. Supervisors must ensure the potential for radiation exposure is addressed in the planning, measures to address these exposures are documented in safety plans or radiation work permits, and the workers have adequate training to understand the hazards and the protective measures. Continual oversight shall be maintained to evaluate ways radiation exposures can be minimized. Best judgement should be exercised when weighing the costs and benefits of further dose reduction. Employee participation in ALARA activities shall be maximized.

INTRODUCTION

Employees, visitors, and contractors of Martin Marietta Energy Systems, Inc., (Energy Systems) at the Paducah Gaseous Diffusion Plant (PGDP) face a number of potential hazards at the plant site. While they cannot be eliminated entirely, these hazards can be minimized through the development and implementation of prudent safety practices. Exposure to ionizing radiation is one such hazard.

PGDP is in the process of upgrading its radiation protection activities in order to be in full compliance with Department of Energy (DOE) 5480.11 and to provide its employees, contractors, visitors, and the general public the highest degree of protection associated with the nuclear industry.

The following sections of this program contain the specific statements of policy operations guidance applicable to PGDP. These, along with the plant policy statement shown previously in this document, comprise the PGDP Radiation Protection Program.

PURPOSE

The primary purpose of this Radiation Protection Program is to provide guidance to management, supervision, and the Radiation Protection staff concerning radiation protection activities at PGDP. This guidance is provided in order to minimize the total risk of harm or injury incurred by personnel as a result of ongoing operations involving exposure to radiation and radioactive materials.

This Radiation Protection Program also defines steps to be taken to assure full compliance with DOE 5480.11 and establishes individual and group management responsibilities for assuring such compliance.

RADIATION PROTECTION GUIDANCE

Implementation of this program will be accomplished by a division of operational and programmatic responsibility. As explained below, line management is charged with the implementation of this program. The manager of the Health Physics Department will provide technical and operational support to line managers.

Program managers are responsible for the achievement of their programmatic responsibilities as defined below.

HEALTH PHYSICS ORGANIZATION AND ADMINISTRATION

Overall control and responsibility for radiological protection at PGDP shall rest with the plant manager. The plant manager shall:

1. Establish PGDP policy and revise/amend this Radiation Protection Program Plan accordingly.

2. Assure that the capability of PGDP radiation protection services are sufficient to meet programmatic requirements.

3. Make this Radiation Protection Program available to employees upon request.

4. Cause the contents of this Radiation Protection Program to be communicated to employees in formal training programs.

5. Organize a PGDP radiation protection committee that meets at least semiannually, consisting of the deputy plant manager, the radiation safety officer/radiation protection manager (RPM), Health Physics department manager, representatives of selected Operations departments, the PGDP quality assurance officer, and at least one radiation protection professional who is not an employee of Energy Systems. This committee shall be chaired by the deputy plant manager, and provides oversight for the implementation of this Radiation Protection Program.

The plant manager shall delegate the authority for coordinating the implementation of this Radiation Protection Program to an RPM who will report to the Health Physics department manager.

1. The RPM at PGDP shall be a person whose qualifications are similar to those required to manage a U.S. Nuclear Regulatory Commission (USNRC) Type A Broad Scope License and who meets the qualifications of DOE 5480.20.

2. The RPM shall periodically review and update this Radiation Protection Program and shall prepare annual implementation plans for the achievement of program objectives.

3. The RPM shall have direct communications to the plant manager or the deputy plant manager on matters concerning the implementation of this program.

4. The RPM shall coordinate the accomplishment of this program with the Health Physics department manager.

The plant manager shall delegate authority for contamination control at PGDP to a contamination control program manager who will report to the Health Physics department manager.

1. The contamination control manager shall be a technically qualified "expert" health physicist with three years documented experience in contamination control measures.

2. The contamination control manager shall prepare a contamination control program, annual objectives for contamination control, and implementation plans for the accomplishment of those objectives.

3. The contamination control manager shall coordinate with the Health Physics department manager the accomplishment of the contamination control program.

The plant manager shall delegate authority for an as low as reasonably achievable (ALARA) implementation at PGDP to an ALARA/radiological engineering control program manager who will report to the Health Physics division manager.

1. The ALARA/radiological engineer shall be a technically qualified "expert" health physicist with three years documented experience in ALARA and radiological engineering control measures.

2. The ALARA/radiological engineer shall prepare an ALARA program, annual objectives for ALARA, and implementation plans for the accomplishment of those objectives.

3. The ALARA/radiological engineer shall assist the manager of the Health Physics Department and operating management in the accomplishment of the ALARA program objectives.

4. The ALARA/radiological engineer is responsible for design process and procedure review for ALARA purposes.

The plant manager shall delegate authority for internal and external dosimetry to a dosimetry program manager who will report to the Health Physics department manager.

1. The dosimetry program manager shall be a technically qualified "expert" health physicist with three years documented experience in internal and external dosimetry.

2. The dosimetry program manager shall prepare internal and external dosimetry programs, define annual objectives for dosimetry and dose assessment, and prepare implementation plans for the accomplishment of those objectives.

3. The dosimetry program manager shall coordinate with the manager of the Health Physics Department the accomplishment of the internal and external dosimetry program.

The plant manager shall appoint a person of demonstrated managerial and technical skills to direct the activities of the Health Physics Department who will report to the Environmental, Safety, and Health division manager.

1. The Health Physics department manager shall be responsible for determining the type and quantity of radiation protection staff and resources necessary for full implementation of this Radiation Protection Program.

2. The Health Physics department manager shall ensure that an adequate number of sufficiently trained personnel are available to perform each operation such that administrative individual and cumulative average external dose limits are not exceeded.

3. The Health Physics department manager shall ensure that adequate numbers of sufficiently trained personnel are available to measure and evaluate the intake of radioactive materials and assure that administrative individual and cumulative average internal dose limits are not exceeded.

4. The Health Physics department manager shall ensure that program managers efficiently coordinate their respective program activities.

5. All radiation protection personnel at PGDP shall report, administratively, to the Health Physics department manager.

6. Health Physics Department personnel shall perform radiation protection activities as assigned by the Health Physics department manager.[1]

> Job titles used in this section can be applied to new positions, or these functional roles may be assigned as additional duties to Health Physics Department personnel.

ALARA (AS LOW AS REASONABLY ACHIEVABLE)

Radiation exposures and the release of radioactive effluents to the environment shall be held as low as reasonably achievable at PGDP with technical, economic, and societal factors being taken into account. Managers and supervisors are responsible for the planning and conduct of work to minimize exposure to radiation and radioactive materials and to achieve PGDP ALARA objectives.

ALARA can best be accomplished by abiding by the following steps:

1. Knowing the sources and types of radiation exposure that could be encountered in a work activity.

2. Planning and conducting work to ensure minimum exposure potential.

3. Assuring, by the provision of training, posting of signs, placement of barriers, use of radiation work permits, and use of prejob safety meetings, that employees are aware of sources of radiation and radiological hazards in the workplace.

4. Assuring that employees have adequate protective equipment to safely accomplish the job or task.

5. Periodically reviewing employee exposure and evaluating methods of exposure reduction.

6. Making procedural changes to reduce exposure potential.

7. Submitting all procedural, process, and design proposals and modifications to the ALARA/radiological engineer for review and implementing recommended changes that will reduce exposure.

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1. In certain circumstances, functions may be performed by contractors to PGDP, consultants, and properly trained/qualified PGDP technical personnel assigned to other departments/divisions. However, the responsibility to ensure that personnel at PGDP are protected from radiation hazards shall remain with the RPM and the Health Physics department manager.

STOP-WORK AUTHORITY

Health Physics department personnel shall have the responsibility and authority to stop or to prevent initiation of a job, test, or any work activity involving radiation protection if continued performance of the work would result in the violation of regulatory administrative standards, policies, or procedures or endanger the safety of personnel.

1. Stop-work orders shall be immediately communicated to the Health Physics department manager and to the shift superintendent on duty.

2. Specific work activities shall be permitted to proceed to a safe condition after issuance of the stop-work order.

3. Stop-work orders involving violation of radiation protection principles shall be canceled only after the Health Physics department manager and the RPM ascertain that the initiating conditions have been alleviated.

4. A procedure for the use of the stop-work authority shall be prepared and distributed to Health Physics and operational personnel.

5. Occurrence reports shall be prepared as appropriate (see DOE 5000.3A).

MANAGEMENT OF TRANSURANIC (TRU)-MODIFIED MATERIALS

Areas, workplaces, process buildings, sumps, or pits where TRU elements could be potentially present should be identified as TRU-modified material handling areas or facilities. The manager of the Health Physics Department shall identify, mark, or cause to be posted all TRU-modified material areas or facilities. The provisions of the section shall be included in the PGDP TRU-Modified Material Handling Program. The following exposure limits will be enforced when working with TRU-modified materials.

Employee effective dose limits, exposure to minors, exposure of the fetus and fertile females, exposure of visitors, and exposure of the general public shall be as specified in the appropriate sections of DOE 5400.3 and DOE 54780.11.

Exposure to TRU modified material in air shall be governed by the following limits:

1. 7E-12 uCi/mL when the aerosol contains less than 25 percent TRU.

2. 2E-12 uCi/mL when the aerosol is known or <u>suspected</u> to contain above 25 percent TRU elements.

3. 2E-12 uCi/mL when the percent TRU is unknown.

Equipment and surfaces shall be decontaminated to levels less than those shown below. The selection of limits depends on how much TRU material is present.

1. For TRU-modified material containing less than 25 percent TRU, total surface contamination should not exceed 1000 dpm per 100 square centimeters and transferable contamination shall not exceed 75 dpm per 100 square centimeters.

2. For TRU-modified material containing more than 25 percent TRU, total surface contamination shall not exceed 300 dpm per 100 square centimeters and transferable contamination shall not exceed 20 dpm per 100 square centimeters.

3. When the percent of TRU elements present is not known, the limits for TRUs shall apply which are 300 dpm per 100 square centimeters total alpha and 20 dpm per 100 square centimeters transferable alpha.

4. For material known to contain less than 1 percent TRU, it is desirable to decontaminate surfaces to below 5000 dpm per 100 square centimeters total alpha contamination and 1000 dpm per 100 square centimeters transferable alpha.

5. For material emitting beta-gamma radiation only, total contamination limits shall be less than 5000 dpm per 100 square centimeters total and 1000 dpm per 100 square centimeters transferable.

6. For surface contamination by both alpha- and beta-gamma emitting nuclides, the limits for alpha and beta gamma emitting nuclides shall apply separately.

The following work rules shall be followed, as a minimum, when working with TRU-modified materials:

1. Personal shoes and clothing shall be stored separately from company-owned shoes and clothing in locker rooms and change rooms.

2. Change rooms shall be designed and operated following the radiological-nonradiological side concept.

3. Only company-owned shoes and clothing shall be worn in regulated areas of TRU-modified material handling facilities. Personal clothing may be worn to and from change houses, break rooms, lunchrooms, etc., via the green walkways.

4. The use or wearing of company-owned equipment and shoes outside of TRU-modified material buildings shall be in accordance with UE-SPP-ESH-6.

5. Contamination areas and regulated areas shall be designated on the basis of fixed and removable contamination present.

6. Work upon equipment contaminated with, or potentially contaminated with, TRU elements shall be conducted in specifically identified areas and locations. If possible, certain areas should be identified where work on TRU equipment shall be conducted.

7. All welding, grinding, buffing, or work that can potentially expose workers to airborne material shall be conducted in full anti-contamination clothing. Respirators shall be worn during the conduct of such work. Local exhaust ventilation providing a capture velocity of 100 linear feet per minute or ventilated enclosures providing a negative pressure shall be employed.

8. Supervisory and other personnel making occasional entries into contamination areas to perform non-hands-on work shall be permitted to wear a yellow lab coat over company supplied clothing, gloves with cotton inserts, and shoe covers. This rule shall apply only when there is no physical contact and there are no conditions requiring respiratory protection or the use of full anti-contamination clothing.

9. Health Physics technicians monitoring job and task activities shall utilize the same level of protection as personnel conducting the job.

10. Employees, visitors, contractors, and subcontractors shall use whole-body monitors, half-body monitors, or hand-and-foot monitors placed at all points of routine egress from building and at the entrances to nonradiological areas such as lunch rooms, change rooms, etc.

11. Smoking shall be prohibited in all areas of TRU-modified material handling facilities.

12. Real-time air monitors should be deployed to monitor the general work environment in TRU facilities. The use of passive air monitors shall continue to verify general workplace conditions.

13. Process equipment shall be assumed to contain 100 percent TRU until proven otherwise by isotopic analysis.

14. Areas such as sumps, pits, etc., known to accumulate TRU shall be treated as if they contained 100 percent TRU unless proven otherwise by isotopic analysis.

15. Within the TRU-modified material buildings, areas shall be surveyed for TRU contamination as soon as the handling of material is finished and shall be immediately decontaminated to levels consistent with limits specified for TRU facilities.

16. Within the TRU-modified material buildings, real-time air monitors shall be deployed to monitor any job activity with a potential for making the transuranic material airborne.

17. Work shall be conducted in a manner that limits the generation of airborne materials.

In vivo analysis and urinary bioassay for TRUs shall be provided as specified below.

1. Employees having a high potential for exposure to the TRU elements shall be included in a routine urinary bioassay program. Participation shall be mandatory.

2. Special bioassays shall be conducted when the air concentration exceeds the derived air concentration (DAC), intake of airborne TRU elements potentially exceeds 40 DAC hours in the event of skin contamination, or when unprotected exposure to transferable surface contamination exceeds 50 times the limits specified above.

3. Individuals showing two consecutive urinary bioassay results above recall levels should be considered as candidates for in vivo analysis.

4. Employees exposed to TRU elements should receive periodic whole-body counts.

TRAINING IN RADIOLOGICAL PROTECTION

Training programs shall be established to ensure that all employees, contractors, and visitors are familiar with plant radiation protection policies and with the provisions of this Radiation Protection Program.

All personnel with unescorted access to the controlled areas of PGDP shall be trained in proper provisions of radiation protection in accordance with DOE 5480.11. This training may consist of general employee training (GET), radiation worker training, radiation worker supervisor training, and/or special briefings.

Employee training shall be consistent with the level of risk encountered in the workplace.

General Employee Training

GET is designed to provide a limited awareness of PGDP radiation protection practices to all employees who may encounter radiological hazards as a result of their job description or work location, but who are not considered to be radiation workers. The risk of radiation injury to the embryo/fetus shall be explained prior to employment to each employee and their supervisor. GET shall consist of class attendance in the following topics:

1. The risk of low-level occupational radiation exposure.
2. The risk of prenatal radiation exposure.
3. Basic radiation protection concepts.
4. U.S. DOE and PGDP radiation protection policies and procedures.
5. Employee and management responsibilities for radiation safety.
6. Identification of radiological postings, barriers, labels, boundary control stations, and monitors.
7. Radiological emergency procedures.

Radiation Worker Training

Radiation worker training shall impart comprehensive knowledge of radiation protection activities at PGDP. This training shall be equivalent to that recommended by USNRC Regulatory Guide 8.29, *Instruction Concerning Risks From Occupational Radiation Exposure* and consistent with the provisions of DOE 5480.11.

Radiation worker training shall be provided to all employees, visitors, or contractors permitted unescorted access to radiological areas, contamination areas, airborne radioactivity areas, or to personnel who may receive in excess of 100 millirem in one calendar year.

Radiation worker training shall consist of formal classroom, plant-specific, and on-the-job training in the following topics:

1. Radioactivity and radioactive decay.
2. Characteristics of ionizing radiation.
3. Man-made radiation sources.
4. Acute effects of exposure to radiation.
5. Risks associated with occupational radiation exposures.
6. Special considerations in the exposure of women of reproductive age.
7. Dose equivalent limits.
8. Modes of exposure (internal and external).
9. Dose equivalent determinations.
10. Basic protection measures (time, distance, shielding).
11. Specific PGDP procedures for maintaining exposures as low as is reasonably achievable.
12. Radiation survey instrumentation, calibration, limitations.
13. Contamination control, including the use of protective clothing and equipment, and workplace design.
14. Personnel decontamination.
15. Emergency procedures.
16. Warning signs, labels, barriers, and alarms.
17. Responsibilities of employees and management.
18. Interactions with Health Physics Department members and other radiation protection personnel.
19. Operational procedures associated with specific job assignments (i.e., radiation-generating machines, glove boxes, etc.).

Radiation Worker Supervisor Training

Advanced training in radiation protection shall be available, on a case-by-case basis, to provide comprehensive and in depth knowledge of certain radiation protection topics (e.g., respiratory protection devices, containment facilities, engineering controls). Advanced training in radiation protection shall be determined and arranged by the Health Physics department manager.

Special Briefings

Special briefings and job mock-ups shall be required for those personnel involved in work activities associated with significant radiological hazard.

The requirement for special briefings shall be specified in Radiation Work Permits (RWPs) or as determined by the Health Physics department manager. The level of training in radiological protection required for each employee, visitor, or contractor should be commensurate with the potential risk. Training needs for employees will vary and may require upgrades as work progresses. Certain training may also be required by contractual obligations. Training shall be updated at least biennially.

Training records shall be maintained for the Health Physics Department by the Training Department, and include:

1. Attendance sheets
2. Results of proficiency examinations[2]
3. Copies of proficiency examinations
4. Course lesson plans

TRAINING AND QUALIFICATIONS OF RADIATION PROTECTION PERSONNEL

To provide optimum radiation protection for employees, visitors, contractors, facilities, the environment, and members of the general public, PGDP shall provide sufficient qualified radiation protection personnel of the following types:

1. Operational health physicists
2. Applied health physics technicians
3. Ancillary health physics personnel
4. Health physics consultants as needed to support existing staff.

The Health Physics department manager shall determine the number and qualifications of each type necessary to ensure full implementation of the Radiation Protection Program. Personnel of each type shall have the minimum qualifications specified in American National Standards Institute (ANSI) N18.1.[3]

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2. Proficiency examinations are required only for participants in radiation worker training.

3. American National Standards Institute, ANSI-N18.1, "Selection and Training of Nuclear Power Plant Personnel."

EXTERNAL RADIATION EXPOSURE CONTROL

External Exposure Limits

Regulatory external exposure limits for PGDP employees, visitors, and contractors shall be consistent with those established by the U.S. DOE in DOE 5480.11. The cumulative average exposure for PGDP employees, visitors, and contractors shall be 10 percent of the regulatory limits or less.

External Exposure of the Unborn

It is the responsibility of the radiation worker to promptly inform the Medical Department when she suspects she may be pregnant (confirmed or not) or when she intends to become pregnant.

Immediately upon notification of pregnancy (or intent to become pregnant), Occupational Health Services shall notify the Health Physics Department, thereby initiating an investigation to determine the workplace radiation exposure potential for the employee.

By regulation, external exposure limits for the unborn child shall not exceed 500 millirem for the entire gestational period. Administrative dose limits, therefore, require the pregnant worker's exposure be limited to 50 millirem or less per month.

If evaluation of the employee's workplace indicates the above administrative limits will not be exceeded, the decision to continue her present work assignment and/or to continue working in her present work area shall be made by the employee with advice from her attending physician. If workplace evaluation indicates the administrative limits may be exceeded, a reasonable effort will be made to provide a lateral temporary move until the pregnancy reaches termination.

Tranining with respect to fetal protection shall emphasize the importance of prompt declaration of a pregnancy.

External Exposure Monitoring

All employees, visitors, contractors, and subcontractors at PGDP shall be assigned a personnel dosimeter to wear while on-site. The PGDP external personnel dosimetry program shall be accredited by the Department of Energy Laboratory Accreditation Program. All personnel dosimeters used for the external dose of record for each employee, visitor, or contractor shall consist of thermoluminescent dosimeters. Dosimeters for the wrist, hand, fingers, or other extremities will be provided as required by the job task or work situation.

INTERNAL RADIATION EXPOSURE CONTROL

Internal Exposure Limits

Regulatory internal exposure limits for PGDP employees, visitors, and contractors shall be consistent with those established by the U.S. DOE in DOE 5480.11. Administrative goals for the average annual intake of radioactive materials by PGDP employees, visitors, and contractors shall not exceed 5 percent of the regulatory limits.

Internal Exposure Monitoring

PGDP personnel shall participate in a program of internal exposure monitoring whenever required by radiological conditions, contractual requirements, or regulations. The routine internal radiation monitoring program shall consist of either direct or indirect bioassay sampling for all radiation workers. In addition, pre- or post-employment bioassays shall also be performed:

1. As part of the pre-employment physical examination.
2. When an individual's potential intake could exceed 2 percent of the annual limit of intake (ALI)(40 DAC hours exposure).
3. Whenever an administrative limit for air or surface contamination may have been exceeded.
4. Whenever a nasal smear reveals the presence of radioactivity.
5. At least annually when a radiation worker's job is greater than a one-year duration.
6. On a random, periodic basis to verify the adequacy of exposure control methods.
7. Whenever requested by a PGDP employee.
8. When leaving Energy Systems employment at PGDP.

Individuals potentially exposed to TRU elements shall be included in a urinary bioassay program for TRUs. Monitoring methodologies and frequencies shall be appropriate for detecting the types and quantities of radioactive materials in use by the employee. Urinary bioassays shall be the primary monitoring method for technetium, uranium, and the TRU elements. In vivo analysis shall be the method of choice for the determination of material retained having a long effective half life. The choice of monitoring methodologies shall be supported by the preparation of a technical basis document.

Internal Dose Assessment

Internal radiation doses shall be assessed for each PGDP employee, visitor, or contractor involved in the bioassay program at a minimum of once per year. Internal radiation doses shall be reported as annual effective dose equivalent and committed (50 year) effective dose equivalent, assigned in the year in which it was received.[4]

Airborne Radiation Monitoring

An airborne radiation monitoring program shall be implemented and maintained at PGDP. The basis of this program shall be outlined in a technical basis document. Air monitors shall be positioned as determined by air flow studies conducted during each season of the year.

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4. Committed and/or annual doses to individual organs may also be maintained.

Continuous air monitors shall be deployed to support work with equipment containing or contaminated with, or potentially containing or contaminated with, the TRU elements.

The airborne radiation monitoring program shall be maintained by PGDP Health Physics Department personnel, who shall also determine the extent and type of sampling required for each radiological condition.

Air-Monitoring Equipment

Air-monitoring equipment used in the air-monitoring program shall include high- and low-volume air samplers; personal breathing zone air samplers; and alpha, beta, and alpha/beta continuous air monitors. Air-monitoring equipment shall be calibrated for proper response and air flow.

Health Physics Department personnel shall maintain sufficient records to establish the number of DAC-hours received by PGDP employees, visitors, and contractors in order to demonstrate compliance with regulatory limits and administrative limits.

CONTROL OF RADIOLOGICAL WORK

All work involving exposure to radiation or radioactive materials shall be governed by standard operating procedures (SOPs) for routine tasks and RWPs for nonroutine activities. At PGDP, the opening of process systems and the removal of components is considered a nonroutine activity and shall be governed by the provisions of an RWP.

General procedures for the control of work involving radiological protection shall include the following:

1. Establishing radiological standards and responsibilities.

2. Using first-line supervisors and radiological protection personnel to monitor performance of radiological work.

3. Training workers in recognition of radiation hazards and their responsibility to prevent their occurrence.

4. Providing personnel with operating procedures and/or RWPs that include necessary radiological protection measures and controls.

RWPs shall be initiated by the job/task supervisor and shall be approved by the Health Physics area surveyor and the area supervisor, or the Health Physics department manager and the area supervisor. Prior to using an RWP, workers shall sign a statement signifying they have read the RWP, fully understand all requirements and radiological conditions, and agree to comply with these requirements. RWPs and records associated with RWPs shall be maintained in a retrievable, legible form. Changes in the manner of work performance shall require a review of the RWP for potential changes. SOPs for radiological work shall be reviewed for ALARA, process safety, safety, and industrial hygiene prior to implementation (see PGDP plant procedures process).

CONTAMINATION CONTROL

The principal contamination control methods at PGDP shall include identification of sources of contamination, containment of sources of contamination, posting areas appropriately, and controlling access (e.g., entrance and egress) to contaminated areas and decontamination.

Contamination control methods and program objectives shall be defined in the PGDP contamination control plan. As a minimum, the contamination control plan shall include the following provisions:

1. Regulated areas and contamination zones shall be designated on the basis of total and removable contamination.

2. All personnel entering regulated areas shall wear company-owned clothing and shoes. No personal clothing shall be allowed in regulated areas.

3. All personnel entering contamination areas shall wear anti-contamination clothing and respirators required by job procedures or the radiation work permit.

4. Anti-contamination clothing and respirator face pieces used in contamination zones shall be worn once, decontaminated, or discarded.

5. All personnel exiting contamination areas and regulated areas shall perform monitoring using either a whole-body monitor or a hand-and-foot monitor. The use of hand-held, portable instruments shall be restricted to maintenance activities occurring external to existing buildings.

6. All materials/equipment exiting radiological areas shall be surveyed by personnel who have been trained to perform that task.

7. All materials/equipment entering radiological areas shall be kept to a practical minimum and shall be protected to the maximum extent practical.

8. All contaminated materials moved outside of posted radiological areas shall be containerized and shall be appropriately labeled with contamination labels or tags.

9. There shall be no eating, smoking, chewing, dipping, drinking, etc., within contamination areas.

10. There shall be no eating, drinking, dipping, or smoking within regulated areas.

CONTROL OF RADIOACTIVE WASTE

Radioactive waste controls shall be designed to minimize the volume of radioactive waste generated and ensure safe packaging of radioactive materials for transportation and/or disposal. Radioactive waste controls shall be designed to prevent or minimize co-mingling of hazardous material and radioactive material in order to avert generation of mixed waste.

Radioactive material shall be packaged, labeled, and shipped in accordance with applicable federal and state regulations. Radioactive material shipping records shall be maintained in a retrievable, legible form.

In general, control of radioactive waste material shall be accomplished by:

1. Preventing material from becoming unnecessarily and/or excessively contaminated.
2. Decontaminating and reusing material such as tools and equipment.
3. Identifying, controlling, and promptly repairing leaks from radioactive systems.
4. Monitoring material for radioactivity and removing nonradioactive material prior to disposal.
5. Using waste volume reduction techniques (i.e., high-compression, compaction, or incineration, etc.).

Radioactive waste shall be disposed of by transfer to a USNRC-licensed site or a DOE site specifically designated to receive the waste. On-site burial, disposal by dilution in soil or water, or incineration shall not be permitted except as authorized by DOE.

Health Physics will provide technical and operational support to the Chemical and Waste Services Division.

HEALTH PHYSICS INSTRUMENTATION AND RADIOLOGICAL SURVEILLANCE

Sufficient radiation monitoring and surveying shall be conducted to ensure the safety of operating personnel and to assure compliance with the exposure limits of DOE 5480.11. Radiation surveys for air and surface contamination and external radiation exposure shall be conducted on a planned frequency.

Sampling designs for air and surface contamination shall be statistically based to assure the collection of representative data.

Instrumentation used by Health Physics personnel and other PGDP employees:

1. Shall be of sufficient sensitivity and accuracy to assess all radiation exposure levels found at PGDP.
2. Shall be capable of detecting the presence of contamination on tools, equipment, clothing, and personnel at all levels specified in DOE 5480.11.
3. Shall be of sufficient quantity to support ongoing or planned operations.
4. Shall be tested and calibrated as recommended in ANSI N323.[5]

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5. American National Standards Institute, ANSI N323-1978, "Radiation Protection Instrumentation Test and Calibration."

RADIOLOGICAL AREAS AND POSTING/LABELING

Radiological area definitions and posting/labeling requirements throughout PGDP shall be as described in DOE 5480.11. All personnel permitted unescorted access to PGDP controlled areas shall be trained in recognition of posting/labeling.

ENGINEERED CONTROLS AND RESPIRATORY PROTECTION

Engineered controls shall be the primary means whereby intake of airborne radioactivity by workers and/or exposure to external radiation is minimized. Respirator selection shall be in accordance with the provisions of the PGDP Respiratory Protection Program. The use of respirators shall not be permitted unless engineered controls or administrative controls have or can be demonstrated to be not feasible. The following conditions shall apply to the use of respirators:

1. Users shall have had a medical examination and have been medically approved for respirator wear within the last year.

2. Users shall receive training on the topics of respiratory protection and respirators.

3. Users shall pass an acceptable quantitative fit test for all types of negative pressure masks that they will be required to use.

4. Users shall be clean-shaven on all sealing surface areas under the respirator.

5. Users shall be required to inspect the respirator for flaws before each use and perform a positive and negative pressure fit test before entering the airborne activity area.

RADIATION PROTECTION RECORDS

PGDP shall maintain the following records pertaining to radiological protection activities:

1. Training records on each worker indicating time of training, test results, instructor name/company name, test used, and course lesson plans.[6]

2. RWPs and associated records.

3. Radiation exposure records on each worker including both internal and external exposure results in accordance with DOE 5480.11 and 5484.1.

4. Bioassay results for all samples submitted by PGDP employees, visitors, or contractors.

5. Site monitoring data (i.e., ambient surveys, contamination surveys, airborne radioactivity surveys, environmental monitoring surveys, etc.) collected by PGDP personnel.

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6. Responsibility for maintenance of training records is assigned to the Training Department.

6. Employees, visitors, and contractors shall have the right to review their dosimetry records whenever requested.

Termination exposure reports shall be generated by the Health Physics department manager and transmitted to each individual within 90 days of termination.

Radiation protection records shall be maintained for 85 years.

RADIOLOGICAL INCIDENT REPORTING

The PGDP Occurrence Reporting System shall be implemented for reporting and investigating radiological and other incidents.

> Radiological incidents are any incidents which affect the quality, safety, or performance of the radiation protection program.

The goal of the PGDP Occurrence Reporting System reporting program shall be to prevent the recurrence of incidents.

QUALITY ASSURANCE (QA) IN RADIOLOGICAL PROTECTION

All activities conducted as part of the Radiation Protection Program shall be subject to QA requirements. The PGDP QA coordinator shall conduct or sponsor an annual, independent audit/assessment of the Health Physics Department and the plantwide Radiation Protection Program. The QA program shall ensure consistency/accuracy of results and documentation/verification of the PGDP Radiation Protection Program.

Periodically, laboratory and field measurements shall be verified through processes such as split sample measurements, duplicate or replicate measurements, and interlaboratory intercomparisons.

Provisions to ensure quality shall include the following:

1. The development of detailed procedures to implement this radiation program.

2. The conduct of audits/assessments to determine compliance with DOE regulations and the PGDP Radiation Protection Program Plan.

3. The conduct of annual audits and/or surveillance visits of all areas of the PGDP Radiation Protection Program by the Health Physics Department.

4. The conduct of quarterly limited scope audits/assessments by PGDP management.

5. Routine walk-through inspections of all PGDP areas by the Health Physics staff.

A program shall be developed to permit PGDP employees to report items, activities, or procedures which they deem inconsistent with regulatory and/or administrative requirements and the PGDP Radiation Protection Program. As a minimum, this program shall ensure:

1. Complete documentation of the problem.
2. Rapid and adequate supervisory and/or management review.
3. Prompt corrective action and recurrence control.
4. Periodic response back to the initiating employee.

PGDP management shall ensure that there are not punitive consequences resulting from an employee's participation in the program.

Appendix A

DEFINITIONS

1. **Administrative Control Action Level** - The level at which an investigation of exposure is triggered and further exposure must have specific management approval.

2. **Airborne Radioactive Material** - Radioactive material in any chemical or physical form that is dissolved, mixed, suspended, or otherwise entrained in air.

3. **Airborne Radioactivity Area** - Any area within a controlled area where the potential exists for airborne radioactivity concentrations greater than 10 percent of the derived air concentration (DAC).

4. **Ambient Air** - The general air in the area of interest (e.g., the general room atmosphere) as distinct from a specific stream or volume of air which may have different properties.

5. **Annual Limit on Intake (ALI)** - The quantity of a single radionuclide which, if inhaled or ingested in one year would irradiate a person, represented by Reference Manual (ICRP Publication 23) to the limiting value for control of the workplace per paragraph 9j(2) of DOE 5480.11.

6. **Anticontamination Clothing (Anti-C's)** - Protective clothing made available to radiation workers specifically for use within a contamination area or as specified by a radiation work permit (RWP).

7. **As Low As Reasonably Achievable (ALARA)** - An approach to radiation protection to control or manage exposures (both individual and collective to the work force and general public) as low as social, technical, economic, practical, and public policy considerations permit. As used in DOE 5480.11, ALARA is not a dose limit but a process, which has the objective of dose levels as far below applicable limits of DOE 5480.11 as reasonably achievable.

8. **Boundary Control Stations (BCS)** - The area where posting and personnel monitoring equipment are located at the entry/egress points to/from radiologically controlled areas.

9. **Company-Issued Work Clothing** - Clothing or shoes which the company issues to workers for work outside contamination areas.

10. **Contamination Area** - Any area within a controlled area where surface contamination exceeds 10 times but is less than 100 times the guides specified in Attachment II of DOE 5480.11.

11. **Continuous Air Monitor (CAM)** - Instrument that continuously samples and measures the levels of airborne radioactive material on a "real time" basis and has alarm capabilities at preset levels.

12. **Controlled Area** - Any area to which access is managed in order to protect individuals from exposure to radiation and radioactive material.

13. **Derived Air Concentration (DAC)** - The airborne concentration that equals the ALI divided by the volume of air breathed by an average worker for a working year of 2000 hours (assuming a breathing volume of 2.4×10^3 m^3). The value is equal to the derived airborne concentration found in ICRP Publication 30 converted to units of "Ci/ml."

14. **Derived Air Concentration-Hour (DAC-Hr)** - The product of the radioactive material concentration in air (expressed as a fraction or multiple of the DAC for each radionuclide) and the exposure time in hours to that radioactive material.

15. **Direct Survey** - A survey of both fixed and removable radioactive contamination on a surface by simply holding the survey instrument probe/detector near the surface to be monitored.

16. **Facility Manager** - The individual assigned responsibility for all operations within a facility including the physical condition of the facility. This may include a manager's designee for back shifts.

17. **Fixed (Bonded) Contamination** - Radioactive material on a surface which cannot be removed by routine dry and/or wet decontamination techniques. The contamination is not transferred through casual contact and is not detected by routine smear surveys. It may become removable through operations such as grinding, welding, or other abrasive operations.

18. **Fresh Uranium** - Term applied to ^{238}U decay product ingrowth in applying a standard for contamination control policies. For the purpose of contamination control, fresh uranium will be uranium separated from its decay products by physical and/or chemical means less than 30 days ago.

19. **Frisk** - A survey performed with radiation detection instrumentation to determine the presence or absence of radioactive contamination on personnel, equipment, or plant surfaces.

20. **High Contamination Area** - Any area within a controlled area where surface contamination exceeds 100 times the guides specified in Attachment II of DOE 5480.11.

21. **High Radiation Area** - Any area within a controlled area where an individual can receive a dose equivalent of 100 mrem (0.001 sievert) or greater but less than 5 rem (0.05 sievert) in 1 hour at 30 cm from the radiation source or from any surface through which the radiation penetrates.

22. **Indirect Survey (Wipe)** - A survey for removable radioactive material on a surface by wiping with normal hand pressure using nonabrasive wiping mediums. This is normally called a wipe or smear survey.

23. **Initial Action Level (IAL)** - The level at which an investigation of exposure is triggered. The IAL is set at 10 percent of any occupational exposure limit set by DOE 5480.11. If the exposure cannot be measured at or below 10 percent of the applicable limit, the IAL is set at the lowest practical measurable level.

24. **Job Supervisor** - The individual with overall responsibility for a discrete work activity. He issues/approves work packages and associated permits.

25. **Occupational Worker** - An individual who is either a DOE or DOE contractor employee; an employee of a subcontractor to a DOE contractor; or an individual who visits to perform work for or in conjunction with DOE or utilizes DOE facilities.

26. Occurrence Report - A written evaluation of an event or condition that is prepared in sufficient detail to enable the reader to assess its significance, consequences, or implications, and to evaluate the actions being proposed or employed to correct the condition or to avoid recurrence.

27. Personnel Survey (Frisk) - The survey of an individual's skin, clothing, personal items, and shoes to determine if they are contaminated.

28. Qualified Expert - A person who by virtue of documented education, training, experience, and reputation has special knowledge of an area of technical expertise.

29. Quarter - Any of the four calendar periods of January-March, April-June, July-September or October-December.

30. Radiation Area - Any area within a controlled area where an individual can receive a dose equivalent greater than 5 mrem (50 microsieverts) but less than 100 mrem (1 millisievert) in 1 hour at 30 cm from the radiation source or from any surface through which the radiation penetrates.

31. Radiation Work Permit (RWP) - An authorization form to do work involving radiation or radioactive contamination. The permit requires a radiological review of the job and specifies the radiation protection requirements for the job. The form may be incorporated with other safety permits.

32. Radiation Worker - An occupational worker whose job assignment involves operation of radiation-producing devices or working with radioactive materials, or who is likely to be routinely occupationally exposed above 0.1 rem (0.001 sievert) per year, which is the sum of the annual effective dose equivalent from external radiation and the committed effective dose equivalent from internal radiation.

33. Radioactive Source Material - As used in this procedure, radioactive material is any material which exceeds ten times the quantity of material as specified in Appendix B of Energy Systems Standard ESS-ESH-108.

34. Radioactive Material Storage Area (RMSA) - Any location where discrete radioactive sources or contaminated items such as tools or equipment are kept when not in immediate use. Contaminated facilities and installed contaminated systems do not constitute "storage."

35. Radiological Area - Any area within a controlled area where an individual can receive a dose equivalent greater than 5 mrem in 1 hour at 30 cm from the radiation source or any surface through which the radiation penetrates, or when airborne radioactivity concentrations greater than 10 percent of the DAC are present (or are likely to be), or where surface contamination in excess of the guides specified in Table 1 of the Oak Ridge Operations (OR) Radioactive Contamination Control Policy is present (or is likely to be). For the purpose of contamination control, radiological areas include regulated areas, contamination [and high contamination] areas, airborne radioactivity areas, and respirator areas. Note: For the purpose of radiation control, radiological areas include radiation areas, high radiation areas, and very high radiation areas.

36. **Regulated Area** - Any area within a controlled area where surface contamination in excess of but less than ten times the guides specified in Attachment II of DOE 5480.11.

37. **Removable (transferrable, loose) Contamination** - Contamination which can be removed with smears using only normal pressure. Contamination which can be easily transferred to personnel or surfaces through casual contact. Removable contamination is quantified as the amount of contamination removed by a smear.

38. **Representative Air Sampling** - The sampling of airborne radioactive material in such a manner that the sample closely approximates both the amount of activity and the physical and chemical properties (e.g., particle size and solubility) of the aerosol to which workers may be exposed.

39. **Respirator Area** - Any area within an airborne radioactivity area where airborne radioactivity concentrations exceed the DAC. Note: This definition is interpreted to mean that the DAC is averaged over the greater of 1 hour or the sample collection time and does NOT apply to instantaneous concentrations.

40. **Retrospective Air Sampling** - Air sampling during (or possibly before) an operation with subsequent off-line analyses to determine the average airborne radioactivity level during the sampling period.

41. **Step Off Pad (SOP)** - The portion of the floor at a radiological area boundary which serves as the access/egress point to the radiological area. The SOP serves as the transition point between radiologically controlled areas.

42. **Survey** - An evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive material or other sources of radiation under a specific set of conditions.

43. **Supervisor** - Personnel having supervisory authority over subordinates.

44. **Very High Radiation Area** - Any area within a controlled area where an individual can receive a dose equivalent of 5 rem (0.05 sievert) or greater in 1 hour at 30 cm from the radiation source or from any surface through which the radiation penetrates.

45. **Visitor** - Any person entering a DOE/OR site who is not an employee nor working under contract to DOE or the facility contractor and who would not be classified as an occupational worker.

46. **Transuranic-Modified Material** - Material containing TRU elements with a TRU constituent of the total contamination of 1 to 25 percent by activity as found in recent and continuing assessments of the site.

47. **Transuranic-Modified Material Area** - Areas within a TRU-modified material building where TRU-modified material is processed, used, etc.

48. **Transuranic-Modified Material Building** - Buildings in which TRU or TRU-modified material is processed, used, etc.

Appendix B

ABBREVIATIONS

Anti-C's	Anti-contamination clothing
ALARA	as low as reasonably achievable
ALI	annual limit of intake
Bg	Becquerel
CCP	Contamination Control Program
cfm	cubic feet per minute
CFR	Code of Federal Regulations
Ci	curie
cm	centimeter (cm^3 = cubic centimeter)
cpm	counts per minute
CY	calendar year
DAC	derived air concentration
DE	dose equivalent
DOE	Department of Energy
dpm	disintegrations per minute
DR	dose rate
E	natural logarithm to base e (E = 2.71828)
ECF	Radiation Work Permit Entry Control Form
ergs	unit of work which can exert a force through one cm
ES	Emergency Squad
ft	foot (ft^3 = cubic foot)
FY	Fiscal Year

GM	Geiger-Mueller
Gy	gray (cGy = centiGray)
HEPA	high efficiency particulate air
HP	Health Physics
ICRP	International Commission on Radiological Protection
L	liter
LLD	lowest limit of detection
lpm	liters per minute
m	meter (m^3 = cubic meter)
MDA	minimum detectable activity
MDCR	minimum detectable count rate
MSDS	material safety data sheet
ORO	Oak Ridge Operations
PGDP	Paducah Gaseous Diffusion Plant
QF	quality factor
RAM	radioactive material
RIR	Radiological Incident Report
RMSA	radioactive material storage area
RSLS	radiation survey log sheet
SCCR	shoe and clothing contamination record
SCR	skin contamination record
SoP	step-off pad
SRPD	self-reading pocket dosimeter
Sv	sievert (cSv = centisievert)
TLD	thermoluminescent dosimeter
uCi	microcurie

Appendix C

REFERENCES

1. DOE 1324.2A, "Records Disposition," which prescribes policies, procedures, standards, and guidelines for the orderly disposition of records of DOE and its operating contractors.

2. DOE 5000.3A, "Occurrence Reporting and Processing of Operations Information," which establishes a system for reporting operations information and the processing of that information to provide for appropriate corrective action.

3. DOE 5400.5, "Radiation Protection of the Public and Environment," which establishes standards and requirements for the protection of members of the public and the environment against undue risk from radiation.

4. DOE 5480.1B, "Environment, Safety, and Health Program for Department of Energy Operations," which outlines environmental, safety, and health protection policies and responsibilities.

5. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards," which identifies mandatory and recommended environment, safety, and health standards.

6. DOE 5480.11, "Radiation Protection for Occupational Workers," which establishes radiation protection standards and program requirements for DOE and DOE contractor operations with respect to the protection of the worker from ionizing radiation.

7. DOE 5480.15, "Department of Energy Laboratory Accreditation Program for Personnel Dosimetry," which defines requirements for participation in the DOE Laboratory Accreditation Program.

8. DOE 5480.19, "Conduct of Operations Requirements for DOE Facilities," which provides requirements and guidelines for directives, plans, and/or procedures related to the conduct of operations at DOE facilities.

9. DOE 5480.20, "Personnel Selection Qualification, Training, and Staffing Requirements at DOE Reactor and Nonreactor Nuclear Facilities," which establishes the selection qualification training and staffing requirements for personnel involved in the operation maintenance and technical support of DOE-owned Category A and B reactors and nonreactor facilities.

10. DOE 5482.1B, "Environment, Safety, and Health Appraisal Program," which establishes the DOE environmental protection, safety, and health protection appraisal program.

11. DOE 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements," which establishes procedures for the reporting of information having environmental protection, safety, or health protection significance.

12. DOE 5700.6B, "Quality Assurance," which sets forth actions for establishing, implementing, and maintaining actions to assure quality achievement in DOE programs.

13. DOE 6430.1A, "General Design Criteria," which provides general design criteria for the acquisition of DOE facilities.

14. DOE Publication DOE/EH-0026, *Handbook for the Department of Energy Laboratory Accreditation Program for Personnel Dosimetry System*, which provides operating procedures for the program.

15. DOE Publication DOE/EH-0027, *Department of Energy Standard for the Testing of Personnel Dosimetry System*, which provides the performance testing criteria used to accredit personnel dosimeters.

16. DOE Publication DOE/EH-0070, *External Dose-Rate Conversion Factors for Calculation of Dose to the Public*, of July 1988, which provides conversion factors for use in calculating dose from radionuclides external to the body.

17. DOE Publication DOE/EH-0071, *Internal Dose Conversion Factors for Calculation of Dose to the Public*, of July 1988, which provides conversion factors for use in calculating dose from radionuclides in the body.

17. DOE Publication PNL-6577, *Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels That Are as Low as Reasonably Achievable (ALARA)*, of July 1988, that provides contractor personnel with general guidance regarding programs and techniques to reduce radiation exposure to ALARA.

18. DOE Publication EGG 2530, *Health Physics Manual of Good Practices for Uranium Facilities*, which provides guidance for radiation protection programs in uranium facilities.

19. DOE Publication ORAU 88/H-9, *Guide to Good Practices in Radiation Protection Training*, which provides guidance for general employee, radiation worker, and health physics technician training.

20. National Council on Radiation Protection and Measurements (NCRP) Report 53, *Review of NCRP Radiation Dose Limit for Embryo Fetus in Occupationally Exposed Women.*

21. NCRP Report 57, *Instrumentation and Monitoring Methods for Radiation Protection.*

22. NCRP Report 59, *Operational Radiation Safety Program.*

23. NCRP Report 84, *General Concepts for the Dosimetry of Internally Deposited Radionuclides.*

24. NCRP Report 87, *Use of Bioassay Procedures for Assessment of Internal Radionuclide Deposition.*

25. NCRP Report 90, *Neptunium: Radiation Protection Guidelines.*

26. NCRP Report 91, *Recommendations on Limits for Exposure to Ionizing Radiation.*

27. International Commission on Radiological Protection (ICRP) Publication 23, *Reference Man Anatomical Physiological Metabolic Characteristics.*

28. ICRP Publication 26, *Recommendations of the International Commission on Radiological Protection.*

29. ICRP Publication 30, *Limits for Intakes of Radionuclides by Workers.*

30. ICRP Publication 32, *Limits for Inhalation of Radon Daughters by Workers.*

31. ICRP Publication 35, *General Principles of Monitoring for Radiation Protection of Workers.*

32. ICRP Publication 37, *Cost-Benefit Analysis in the Optimization of Radiation Protection.*

33. ICRP Publication 48, *The Metabolism of Plutonium and Related Elements.*

34. ICRP Publication 60-1990, *Recommendations of the International Commission on Radiological Protection.*

35. American National Standards Institute (ANSI) N2.1, "Radiation Symbol."

36. ANSI N2.3, "Immediate Evacuation Signal for Use in Industrial Installations Where Radiation Exposures May Occur."

37. ANSI N8.3, "Criticality Accident Alarm."

38. ANSI N12.1, "Fissile Material Symbol."

39. ANSI N13.1, "Guide to Sampling Airborne Radioactive Materials in a Nuclear Facility."

40. ANSI N13.3, "Dosimetry for Criticality Accidents."

41. ANSI N13.4, "Specifications of Portable X- or Gamma-Radiation Survey Instruments."

42. ANSI N13.6, "Practice for Occupational Radiation Exposure Record Systems."

43. ANSI N13.15, "Performance of Personnel Thermoluminescence Dosimetry Systems."

44. ANSI N13.22, "Bioassay Programs for Uranium."

45. ANSI N13.52, "Performance Specifications for Direct Reading and Indirect Reading Pocket Dosimeters for X- and Gamma-Radiation."

46. ANSI N42.17A, "Performance Specifications for Health Physics Instrumentations for Use in Normal Environmental Conditions."

47. ANSI N42.17B, "Performance Specifications for Health Physics Instrumentation-Occupational Airborne Radioactivity Monitoring."

48. ANSI N42.17C, "Performance Specifications for Health Physics Instrumentation-Portable Instruments for Use in Extreme Environmental Conditions.

49. ANSI N43.2, "Radiation Safety for X-Ray Diffraction and Fluorescence Analysis Equipment."

50. ANSI N317, "Performance Criteria for Instrumentation Used for In-Plant Plutonium Monitoring."

51. ANSI N319, "Personnel Neutron Dosimeters (Neutron Energies Less Than 20 MeV)."

52. ANSI N320, "Performance Specifications for Reactor Emergency Radiological Monitoring Instrumentation."

53. ANSI N322, "Inspection and Test Specifications for Direct and Indirect Reading Quartz Fiber Pocket Dosimeters."

54. ANSI N323, "Radiation Protection Instrumentation Test and Calibrations."

55. ANSI N510, "Testing of Nuclear Air Cleaning Systems."

56. ANSI N543, "General Safety Standard for Installations Using Nonmedical X-Ray and Sealed Gamma-Ray Sources."

57. ANSI Z88.2, "Practices for Respiratory Protection."

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PADUCAH GASEOUS DIFFUSION PLANT

MARTIN MARIETTA

IMPLEMENTATION OF A TRANSURANIC MODIFIED MATERIALS MANAGEMENT PROGRAM

H. T. Miller

January 1992

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IMPLEMENTATION OF A TRANSURANIC MODIFIED MATERIALS MANAGEMENT PROGRAM

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This action plan is intended to provide a phased approach for the management of transuranic (TRU) modified materials at the Paducah Gaseous Diffusion Plant (PGDP) as described in Standard Practice Procedure (SPP) P-ESH-135. This graded approach is outlined because of logistical and other difficulties associated with full and immediate implementation. It should be noted that the limits for pure TRU materials are now being applied in process, chemical and waste management, and maintenance buildings. This is to assure the maximum level of personal and environmental protection during the procedure's phase-in. Compliance with several sections of SPP P-ESH-135 is required now. Compliance with those sections outlined below is required on the applicable date shown.

This action plan shall be entered into the corrective action system to ensure tracking/reporting and verification of each step and shall be added to the 1992 plant audit list for 1992 or 1993, depending on assigned priorities.

ACTION PLAN FOR SPP P-ESH-135 COMPLIANCE

P-ESH-135 Section	Action Step	Completion Date
5.3	Building managers and the Health Physics Department will identify TRU and TRU-modified material areas within buildings.	01/31/92
	Post appropriate signs.	03/03/92
6.2 and 6.3	Specialized health physics training relative to the TRU program will be conducted for health physics technicians, building contamination control coordinators, and union Environmental, Safety, and Health Committee members.	02/29/92
6.2 and 6.3	Initial employee orientations that include alpha monitoring techniques will be accomplished.	02/29/92
6.2 and 6.3	Employee training in alpha monitoring techniques using a frisker will be included in the initial orientation and general employee training.	03/02/92
6.2 and 6.3	Information concerning the TRU-Modified Materials Management Program will be included in the radiation worker training and radiation worker training upgrades conducted by the Training Department.	03/02/92
6.2 and 6.3	Information concerning the TRU-Modified Materials Management Program will be included in the first-line supervisor training upgrades conducted by the Training Department.	03/02/92
Appendix A and B (General)	Health Physics and Public Relations will publish a series of specialized information bulletins describing the hows and the whys of the TRU-modified material handling programs. Module subject and schedules are shown below:	

P-ESH-135 Section	Action Step	Completion Date
	Announcement of the TRU-Modified Materials Management Program.	01/24/92
	Explanations as to what is different about working with TRU.	01/31/92
	Explanation of the need for alpha and beta monitoring.	02/07/92
	Why personal clothing should be stored separately from company-owned shoes and clothing.	02/16/92
	Changes in the procedures for the monitoring and storage of laundry.	02/23/92
	The concept of a radiological/nonradiological change room and why.	02/23/92
	Announcement of the designation of TRU-modified materials buildings and special Health Physics instructions.	03/01/92
Appendix B, paragraph A	Building and department managers will devise and provide alternative means to isolate company-owned clothing and shoes from personal clothing by March 1992.	03/02/92
Appendix B, paragraph A	Instructions to workers requiring the separation of company-issued clothing and shoes from personal property will be published.	03/10/92
Appendix B, paragraph B	The managers of staff personnel that occasionally work in TRU-modified material buildings and areas will identify for Health Physics the numbers of workers requiring change facilities.	02/15/92
Appendix B, paragraph B	Health Physics will lead a task force and complete the identification of additional lockers and facilities needed.	03/02/92
Appendix B, paragraph B	Additional change areas will be stocked and opened as lockers and other equipment are received.	Ongoing
Appendix B, paragraph B	Health Physics, working with building managers, will determine what modifications need to be made in change houses to conform with TRU requirements and will complete markup drawings and sketches.	03/02/92

P-ESH-135 Section	Action Step	Completion Date
Appendix B, paragraph B	Department managers and building managers will submit Engineering Service Orders (ESOs) to Plant Engineering with suggested modification/layout for each change house requesting cost estimate for each.	04/01/92
Appendix B, paragraph B	Plant Engineering will provide schedules for the preparation of each preliminary ESO response with cost estimate and schedule to obtain necessary approvals (National Environmental Policy Act, Davis-Bacon, funding authorization) to complete design and construction for each change house.	05/01/92
Appendix B, paragraph B	Plant Engineering will proceed with preliminary designs, costs, and schedules and submit a preliminary ESO response for each change house using priorities as directed by Health Physics.	Ongoing
Appendix B, paragraph B	Plant Engineering will proceed with authorizations, design, and construction activities as funding is made available using priorities established by Health Physics.	Ongoing
Appendix B, paragraph C	The plant standard operating procedure for the Radiation Work Permit (RWP) will be completed.	02/01/92
Appendix B, paragraph C	The RWP system will be implemented.	03/01/92
Appendix B, paragraphs C, G, and H	Building and department managers, working with Health Physics, will determine the type, style, and numbers of additional protective clothing for their departments to support the TRU-Modified Materials Management Program and will provide that information to the Purchasing Department. Chemical Operations will be promptly informed of increased requirements also.	02/15/92
Appendix B, paragraphs C, G, and H	Purchase orders to meet the additional protective clothing requirements will be issued.	03/02/92
Appendix B, paragraphs C, G, and H	Health Physics will revise laundry monitoring procedures for company-owned and anticontamination clothing.	02/03/92
Appendix B, paragraphs C, G, and H	Chemical and Waste Services Division will review their laundry operating procedures and complete necessary revisions.	03/02/92

P-ESH-135 Section	Action Step	Completion Date
Appendix B, paragraphs C, G, and H	The requirement for additional laundry capability, over the projected upgrade, will be determined by Chemical Operations within 30 days of the finalization of estimates of increased protective clothing requirements. (A line item project to upgrade the laundry to 8000 pounds per day is scheduled for 1996.)	—
Appendix B, paragraphs C, G, and H	Chemical Operations will determine measures to provide interim laundry services.	04/15/92
Appendix B, paragraphs C, G, and H	If necessary, the upgrade through the use of an interim laundry facility will be accomplished, providing necessary funding is made available.	09/30/92
Appendix B, paragraph I	Alpha and beta sensitive instruments will be positioned at the exits of regulated areas.	02/29/92
Appendix B, paragraph I	Signs prohibiting the use of exits not having alpha monitoring capability will be posted.	03/15/92
Appendix B, paragraph I.6.5	The bioassay program for TRUs will be made operational within one month of the contract laboratory's satisfactory completion of initial quality control evaluations. It is estimated that this will be accomplished by the second quarter of 1992. (Qualification of the laboratory is being expedited, and a set of qualification samples was sent December 13. Other lab capability, including local facilities, is being explored.)	03/31/92
Appendix B, paragraph K	Routine passive air monitoring support will continue. Health Physics' deployment of real-time air monitors in the process building will be accomplished.	09/30/92

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